Special Flood Hazard Evaluation Report Supplement

Breakneck Creek

Portage County, Ohio

Prepared for the
Ohio Department of Natural Resources

US Army Corps
of Engineers
Buffalo District

March 1996

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This report presents local flood hazard information for Breakneck Creek in Franklin Township in the unincorporated areas of Portage County, Ohio and is to be used as a supplement to the Special Flood Hazard Information Report for Fish Creek and Brimfield Ditch dated March 1995. The U.S. Army Corps of Engineers, Buffalo District, will provide interpretation in the application of the data contained in this report.

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SPECIAL FLOOD HAZARD EVALUATION REPORT SUPPLEMENT
BREAKNECK CREEK
COUNTY OF PORTAGE, OHIO

TABLE OF CONTENTS

TABLES

PLATES

MAPS

SPECIAL FLOOD HAZARD EVALUATION REPORT SUPPLEMENT
BREAKNECK CREEK
COUNTY OF PORTAGE, OHIO

INTRODUCTION

This Special Flood Hazard Evaluation Report (SFHE) Supplement documents the results of an investigation to determine the potential flood situation along Breakneck Creek within the unincorporated areas of Portage County, Ohio. This report is a supplement to the SFHE for Fish Creek and Brimfield Ditch which was completed in March 1995 and was conducted at the request of the Ohio Department of Natural Resources under the authority of Section 206 of the 1960 Flood Control Act, as amended. The study reach for Breakneck Creek extends from its confluence with the Cuyahoga River upstream to the Franklin/Ravenna township boundary.

HYDROLOGIC ANALYSES

Hydrologic analyses were carried out to determine the peak discharge-frequency relationship for the flooding source affecting the community. Hydrographs using the 1% and 0.2% precipitation storms were developed for Breakneck Creek at three locations to be used in the unsteady flow model, UNET (Reference 1). It was assumed that runoff from 1% and 0.2% storm events will produce the 1% and 0.2% chance exceedence discharges, respectively. An inflow hydrograph was developed at the Franklin/Ravenna township boundary, approximately 18,000 feet upstream of the confluence with the Cuyahoga River. For simplicity of analysis in this study, the drainage area associated with Congress Lake in the upper watershed was omitted. The total drainage area at this point is 58.6 square miles, excluding the Congress Lake watershed. To account for the vast amount of wetlands located within the drainage area along the main stem, a factor was applied to each hydrograph ordinate to account for percentage of lakes, ponds, and swamps. Additionally, an increase of type A soil land use from that noted on the soil maps was assumed to accommodate for the wetlands when computing the unit hydrograph parameter, CN, for this particular watershed. A second hydrograph was developed for the local inflow from the Brimfield Ditch, Lake Hodgson (aka Muddy Lake) and Sandy Lake contributing watershed. The analysis in this watershed assumed a time of concentration from the upper portion of the watershed through the feeder canal, through both Lake Hodgson and Sandy Lake to the confluence with Breakneck Creek. An imaginary channel configuration through the lakes was assumed to determine the travel time. A percentage of lakes, ponds and swamps was included in the development of the hydrographs to account for Lake Hodgson and Sandy Lake. The drainage area for this local inflow is 9.5 square miles. A third hydrograph was developed for the additional local inflow along Breakneck Creek. The drainage area for this contributing reach is 1.4 square miles.

Both 1% and 0.2% chance exceedence runoff hydrographs were developed for the three locations previously discussed. The hydrographs were calculated using the Dimensionless Unit Hydrograph Method of the Soil Conservation Service. Time of concentration and SCS curve number were calculated using the procedures of TR-55 (Reference 2). Basin

characteristics were determined using USGS topographic maps (Reference 3); field surveys; and Portage and Stark County, Ohio soil maps. All runoff calculations were calculated using the HEC-1 and HEC-DSS computer programs (References 4 and 5).

The peak discharges developed from hydrology and after running the UNET model are compared in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (sq mi)	Peak Discharges From Hydrology 100-Year (cfs)	From Hydrology 500-Year (cfs)	From UNET Model 100-Year (cfs)	From UNET Model 500-Year (cfs)
Breakneck Creek					
Point A at Franklin/Ravenna township boundary	58.56	2500	4210	2500	4210
Point B local inflow of Brimfield Ditch, Lake Hodgson & Sandy Lake	9.51	1420	2300	2500	4250
Point C additional local inflow	1.37	580	1000	2530	4270

HYDRAULIC ANALYSES

Analyses of the hydraulic characteristics of flooding from sources studied were carried out to provide estimates of the elevations of floods for the 100-year and 500-year recurrence intervals.

Cross-section data for the analyses of Breakneck Creek were obtained from field surveys performed by Buffalo District personnel in August 1994. Additional data were obtained from topographic maps (Reference 3). All bridges and culverts were surveyed to determine elevation data and structural geometry.

Water surface elevations for Breakneck Creek were computed using an unsteady flow model (UNET) developed by Dr. Robert Barkau (Reference 1). This model routes a flow hydrograph downstream and accounts for storage in the floodplain.

Location of the selected cross-sections used in the hydraulic analyses are shown on the Flood Profile (Plate 1) and on the Flooded Area Map which accompany this report.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were selected using engineering judgement and were based on field observations of the stream

and flood plain areas. The values for Breakneck Creek ranged from 0.025 to 0.045 in the main channel and 0.050 to 0.150 in the overbank.

A balancing of water surface elevations at the confluence with the Cuyahoga River was performed in order to evaluate the discharge affecting the creek. This balancing was done for flood flows of the selected recurrence intervals.

Flood profiles were drawn showing the computed water surface elevations for the selected recurrence intervals. The flood plain boundaries were delineated using the flood elevations determined at each cross-section. Between cross-sections, the boundaries were interpolated using the topographic maps and spot elevations obtained during the field surveys. Small areas within the flood plain boundaries may be above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodways presented in this study were computed using the Unsteady flow model (UNET) and the Hydrologic Engineering Center's steady state flow model (HEC-2).

Using the peak discharges obtained from the unsteady flow model, an initial floodway alignment was computed using the HEC-2 model and the method of equal conveyance reduction, Method 4 (Reference 6). The resulting floodway stations were input to the UNET model, and a new floodway alignment was computed. A slight increase in peak discharges occurred in the computation of the floodway. This was due to the decrease of storage in the flood plain. The final floodway stations were adjusted to result in a smooth alignment.

The floodways computed in this study are a result of computed encroachment on the floodplain and the reduction of overbank storage. Table 2 shows the increase in discharge as a result of the floodway computations.

TABLE 2
INCREASE IN DISCHARGE AS A RESULT OF FLOODWAY COMPUTATIONS

Location	Existing Discharge	Floodway Discharge	Increase
A	2500	2500	0
B	2500	2750	250
C	2530	2800	270

At the request of the Ohio Department of Natural Resources, the maximum increase in stage due to encroachment was limited to 1 foot, provided that hazardous velocities were not produced. Floodway widths were computed at cross sections and varied from 68 to 545 feet for Breakneck Creek. Between cross-sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross-sections and are shown in Table 3.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
A	1235	100	950	3.1	1040.0	1040.0	1041.0	1.0
B	2270	100	1457	2.4	1040.5	1040.5	1041.5	1.0
C	4000	123	927	4.8	1041.3	1041.3	1042.2	0.9
D	5890	280	1470	4.4	1042.4	1042.4	1043.2	0.8
E	7000	298	1944	3.0	1042.7	1042.7	1043.7	1.0
F	8770	68	433	6.4	1044.0	1044.0	1044.8	0.8
G	9020	195	1194	3.6	1044.9	1044.9	1045.4	0.5
H	12760	545	3577	2.2	1045.8	1045.8	1046.6	0.8
I	16365	164	1029	6.2	1048.1	1048.1	1048.7	0.6
J	16600	90	605	4.8	1048.3	1048.3	1048.8	0.5
K	18000	111	613	4.9	1049.1	1049.1	1050.0	0.9

1 Distance is measured from the confluence with the Cuyahoga River.

TABLE 3

PORTAGE COUNTY, OHIO
(Unincorporated Areas)

FLOODWAY DATA

BREAKNECK CREEK

The computed floodways are also shown on the Flooded Area Maps. In cases where the floodway and the 100-year flood plain boundaries are either close together or collinear, only the floodway boundary is shown.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profile are considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Descriptions of the marks are presented in Table 4.

TABLE 4
ELEVATION REFERENCE MARKS

Reference Mark	Elevation (feet NGVD)	Description
Breakneck Creek		
RM-1	1073.53	Chiseled square, painted yellow, located on the east side of the downstream wingwall of Brady Lake Road bridge over Breakneck Creek.
RM-2	1068.21	Chiseled square in a concrete abutment, south and east of the Baltimore and Ohio Railroad bridge crossing at Route 59, approximately 75 feet south of the bridge.
RM-3	1047.10	Chiseled square, painted yellow, located on the southwest corner of the Route 59 bridge abutment over Breakneck Creek.
RM-4	1052.16	Chiseled square, located on the southwest corner of the abutment wall of Powder Mill Road over Breakneck Creek (+/- .2 feet) below pavement.

CONCLUSION

This reports presents local flood hazard information for Breakneck Creek in Franklin Township in the unincorporated areas of Portage County, Ohio and is to be used as a supplement to the Special Flood Hazard Information report for Fish Creek and Brimfield Ditch dated March 1995. The U.S. Army Corps of Engineers, Buffalo District, will provide interpretation in the application of the data contained in this report, particularly as to its use in developing effective flood plain regulations. Requests should be coordinated with the Ohio Department of Natural Resources.

REFERENCES

1. Robert L. Barkau, One-Dimensional Unsteady Flow Through a Full Network of Open Channels (UNET), version 2.1, Fort Collins, CO, May 1993.

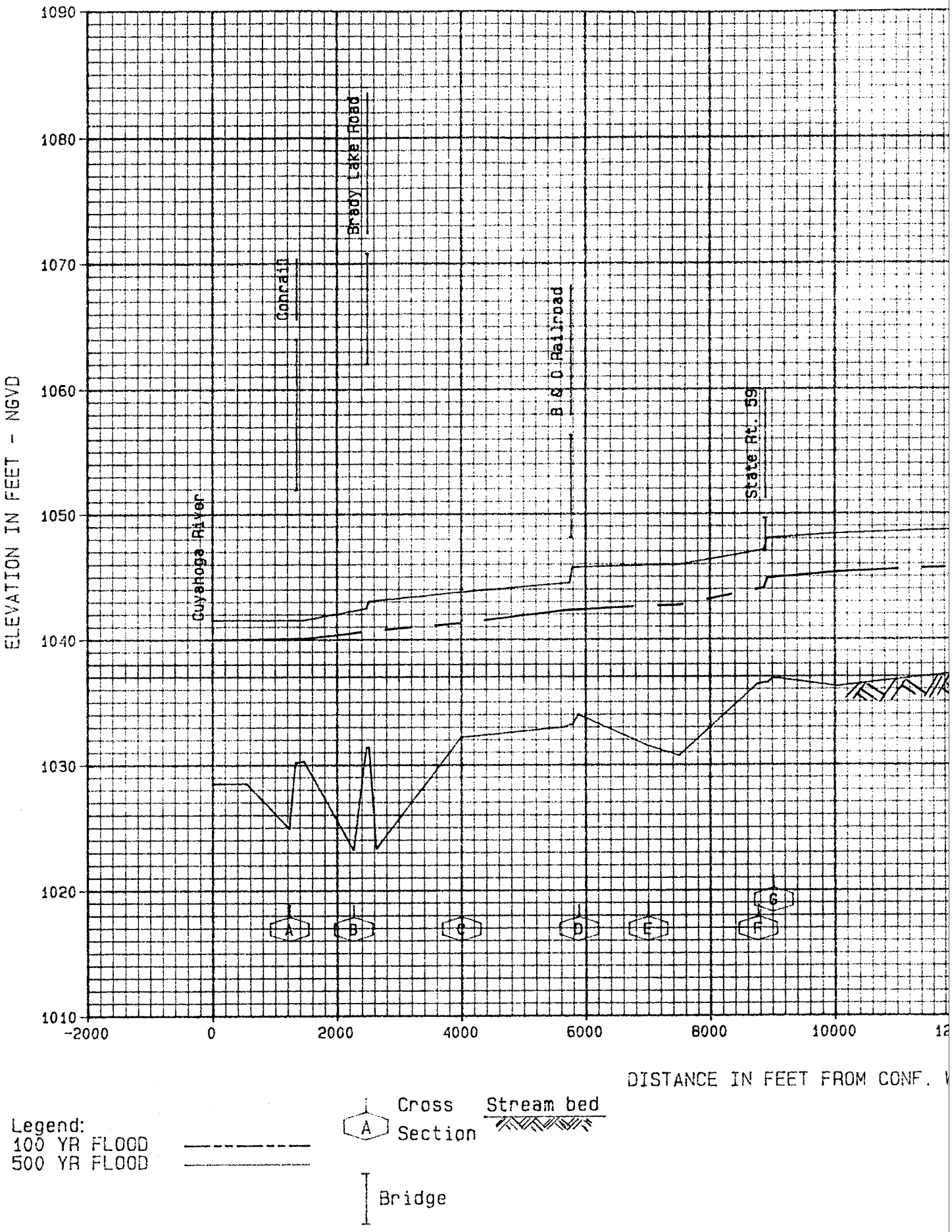
2. U.S. Department of Agriculture, Soil Conservation Service, Technical Release 55 (TR-55) Urban Hydrology for Small Watersheds," 2nd edition (June 1986).

3. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series (Topographic) Maps, Scale 1:24,000, Contour Interval 10 feet: Kent, Ohio (photorevised 1984), Ravenna, Ohio (photorevised 1970), Suffield, Ohio (photorevised 1984), Atwater, Ohio (photorevised 1970), Hartville, Ohio (photorevised 1971), and Limaville, Ohio (photorevised 1971 and 1978).

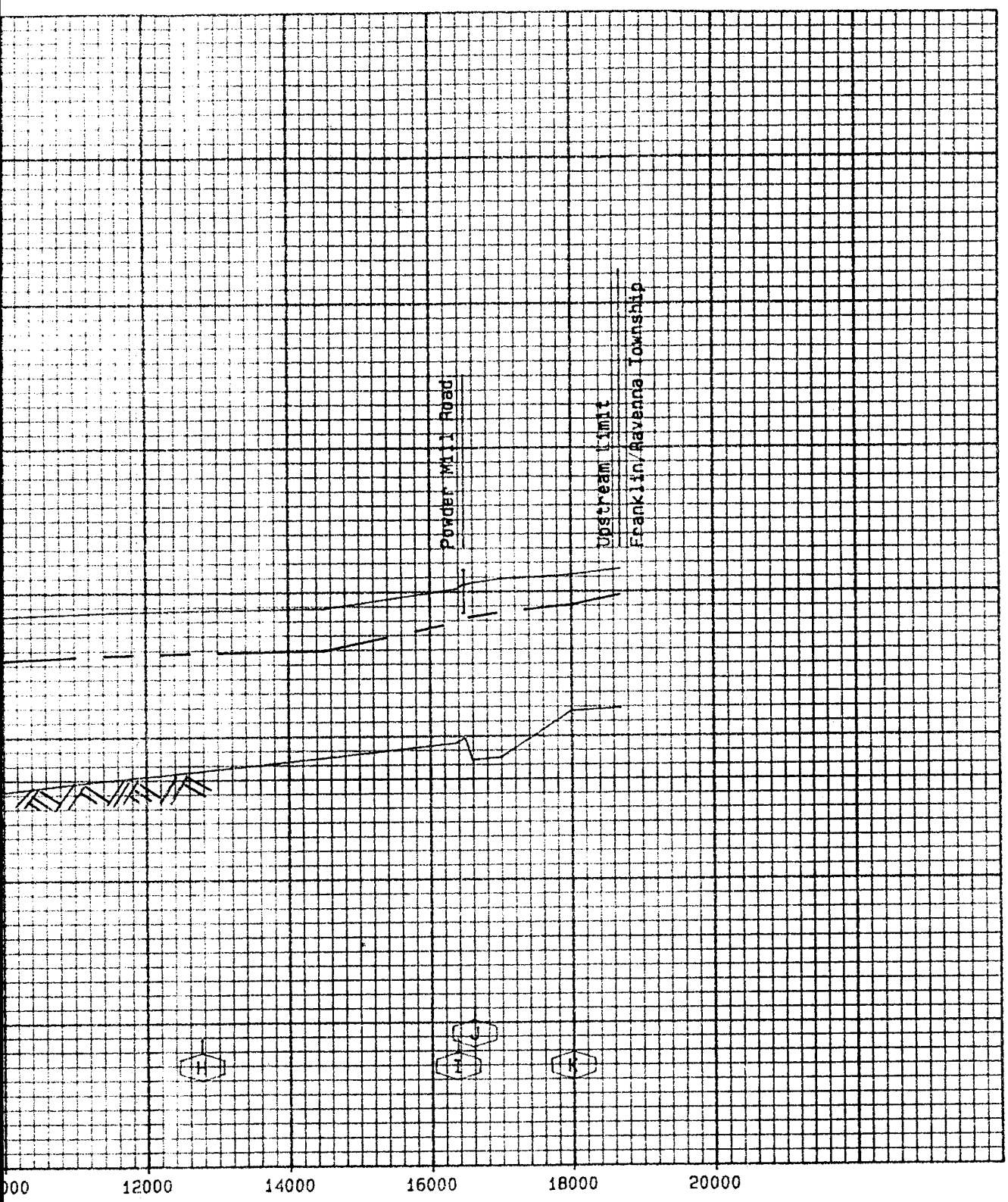
4. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1, version 4.0, Davis, California, September 1990.

5. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-DSS, version 6-FO.

6. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, September 1990.


1
1090
1080
1070
1060
1050
1040
1030
1020
1010
ELEVATION IN FEET - NGVD
Cuyahoga River
Conrail
Brady Lake Road
B & O Railroad
State Rt. 59
A
B
C
D
E
F
G
-2000
0
2000
4000
6000
8000
10000
DISTANCE IN FEET FROM CONF.
Legend:
100 YR FLOOD
500 YR FLOOD
Cross Section
Stream bed
Bridge

(2)



ROM CONF. WITH CUYAHOGA RIVER

SPECIAL FLOOD HAZARD EVALUATION
BREAKNECK CREEK
PORTAGE COUNTY, OHIO

Plate 1 of 1